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UTILITY PATENT APPLICATION TRANSMITTAL <small>(Only for new nonprovisional applications under 37 CFR 1.53(b))</small>	Attorney Docket No.	A65-25311	Total Pages	40
	First Named Inventor or Application Identifier			
	CUNNINGHAM ET AL.			
	Express Mail Label No.	EL013384009US		

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APPLICATION ELEMENTS <small>See MPEP chapter 600 concerning utility patent application contents</small>	ADDRESS TO: Assistant Commissioner for Patents Box Patent Application Washington, DC 20231
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2. <input checked="" type="checkbox"/> Specification [Total Pages 24] <small>(preferred arrangement set forth below)</small> <ul style="list-style-type: none">- Descriptive title of the Invention- Cross References to Related Applications- Statement Regarding Fed sponsored R & D- Reference to Microfiche Appendix- Background of the Invention- Brief Summary of the Invention- Brief Description of the Drawings (if filed)- Detailed Description- Claim(s)- Abstract of the Disclosure	7. Nucleotide and/or Amino Acid Sequence Submission <small>(if applicable, all necessary)</small> <ul style="list-style-type: none">a. <input type="checkbox"/> Computer Readable Copyb. <input type="checkbox"/> Paper Copy (identical to computer copy)c. <input type="checkbox"/> Statement verifying identity of above copies
3. <input checked="" type="checkbox"/> Drawing(s) (35 USC 113) [Total Sheets 10] (Formals)	ACCOMPANYING APPLICATION PARTS 8. <input type="checkbox"/> Assignment Papers (cover sheet & document(s)) 9. <input type="checkbox"/> 37 CFR 3.73(b) Statement <input type="checkbox"/> Power of Attorney <small>(when there is an assignee)</small> 10. <input type="checkbox"/> English Translation Document (if applicable) 11. <input checked="" type="checkbox"/> Information Disclosure Statement (IDS)/PTO-1449 <input checked="" type="checkbox"/> Copies of IDS Citations 12. <input type="checkbox"/> Preliminary Amendment 13. <input checked="" type="checkbox"/> Return Receipt Postcard (MPEP 503) <small>(Should be specifically itemized)</small> 14. <input type="checkbox"/> Small Entity <input type="checkbox"/> Statement filed in prior application. Statement(s) <input type="checkbox"/> Status still proper and desired 15. <input type="checkbox"/> Certified Copy of Priority Document(s) <small>(if foreign priority is claimed)</small> 16. <input type="checkbox"/> Other:
4. Oath or Declaration [Total Pages 3] <ul style="list-style-type: none">a. <input checked="" type="checkbox"/> Newly executed (original or copy)b. <input type="checkbox"/> Copy from a prior application (37 CFR 1.63(d)) <small>(for continuation/divisional with Box 17 completed)</small> [Note Box 5 below]<ul style="list-style-type: none">i. <input type="checkbox"/> <u>DELETION OF INVENTOR(S)</u> Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).	
5. <input type="checkbox"/> Incorporation By Reference (useable if Box 4b is checked) The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.	

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APPLICATION FOR UNITED STATES PATENT

MULTIPLE AND HYBRID GRAPHICS DISPLAYS

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MULTIPLE AND HYBRID GRAPHICS DISPLAY TYPES

2

CROSS-REFERENCE TO RELATED APPLICATIONS

4 Not applicable.

6

BACKGROUND OF THE INVENTION

8 The present invention relates to computer support of multiple display types.

Present computer systems provide a certain amount of flexibility in combining multiple computer displays and display types to a single personal computer, workstation, or embedded system. For example, under the Microsoft Windows 98 operating system, it is possible to simultaneously display images on two displays, but each display must be connected to a video adapter card attached to an ISA or PCI bus via its own slot. The computer must be configured (not in real time) to support the two different adapter cards and the displays attached to them. Graphic libraries and drivers must be identified and employed for each output display type. Different displays cannot be easily swapped without extensive configuration.

The following patents relate to the display portability problem addressed above: U.S. Patent No. 5,960,213, to Wilson, entitled "Dynamically Reconfigurable Multi-Function PCI Adapter Device; U.S. Patent No. 5,948,091, to Kerigan et al., entitled "Universal Digital Display Interface"; U.S. Patent No. 5,910,180, to Flory et al., entitled "Context Virtualizing Device Driver

Architecture"; U.S. Patent No. 5,883,642, to Thomas et al., entitled
2 "Programmable Retargeter Method and Apparatus"; U.S. Patent No. 5,799,204,
to Pesto, Jr., entitled "System Utilizing BIOS-Compatible High Performance
4 Video Controller Being Default Controller at Boot-Up and Capable of Switching
to Another Graphics Controller After Boot-Up"; U.S. Patent No. 5,752,032, to
6 Keller et al., entitled "Adaptive Device Driver Using Controller Hardware Sub-
Element Identifier"; and U.S. Patent No. 5,606,657, to Dennison et al., entitled
8 "Virtual Graphics Processor for Embedded Real Time Display Systems".
However, unlike with the present invention, none of these solutions provide a
10 single display adapter than can simultaneously handle and switch between
multiple displays and display types.

12 Furthermore, the existence of both raster and stroke display types
renders it difficult to use raster-oriented graphics applications with stroke
14 display types. For example, VAPS formats, which are common in the industry,
are unable to drive stroke displays or to properly work with hybrid stroke/raster
16 displays in both modes. The following patents relate generally to this problem,
but none provide the ability of the present invention to drive stroke and hybrid
18 displays using VAPS formats: U.S. Patent No. 5,499,325, to Dugan, Jr., entitled
"Brightness Controls for Visual Separation of Vector and Raster Information";
20 U.S. Patent No. 4,635,050, to Grothe et al., entitled "Dynamic Stroke Priority
Generator for Hybrid Display"; U.S. Patent No. 4,631,532, to Grothe, entitled
22 "Raster Display Generator for Hybrid Display System"; and U.S. Patent No.
4,055,004, to Chase, entitled "Full Color Hybrid Display for Aircraft Simulators."

SUMMARY OF THE INVENTION

The following summary of the invention is provided to facilitate an understanding of some of the innovative features unique to the present invention, and is not intended to be a full description. A full appreciation of the various aspects of the invention can be gained by taking the entire specification, claims, drawings, and abstract as a whole.

The present invention is of a display interface device and method comprising: providing one or more display interfaces connectable to a computer bus of an individual personal computer, workstation, or embedded system; providing a video library; and driving any one of a plurality of video displays of a plurality of types connected to the one or more display interfaces from output of the video library. In a preferred embodiment, the video library comprises video library information, such as OpenGL information. Driving of both stroke and raster display types can be done, as well as simultaneous driving of stroke display(s) of different types or raster display(s) of same or different types (e.g., FPD, HUD, MPD, MPCD, as shown in Fig. 8). Hybrid stroke/raster displays can also be driven. The display interface can be provided by a plurality of interface card mezzanines. Dynamic switching between displays in real time is preferably employed.

The present invention is additionally of a device and method for driving stroke displays using formats designed for raster displays (such as VAPS) comprising: linking generated code from the formats to a standard graphics

library; and providing stroke video drivers that ignore raster masking. In a
2 preferred embodiment, linking is to an OpenGL library. The stroke video drivers
preferably use occlusion memory in place of raster masking. Both stroke and
4 raster displays can be driven and switching dynamically between them is
possible in real time.

6 The present invention is also of a device and method for driving multiple
displays of different types using formats designed for raster displays (such as
8 VAPS) comprising: linking generated code from the formats to a standard
graphics library; driving a plurality of displays of different types from output of
10 the graphics library; and dynamically switching between the displays in real
time. In a preferred embodiment, linking is to an OpenGL graphics library.
12 Driving is of both stroke and raster display types, and the stroke video drivers
are employed using occlusion memory in place of raster masking. Driving of
14 hybrid stroke/raster displays can be performed.

The present invention is further of a device and method for driving a
16 hybrid stroke/raster display using formats designed for raster displays (such as
VAPS) comprising: linking generated code from the formats to a standard
18 graphics library; and providing stroke and raster display inputs from output of
the graphics library. In a preferred embodiment, linking is to an OpenGL
20 graphics library. The stroke video drivers preferably use occlusion memory in
place of raster masking. Dynamic switching can occur between stroke and
22 raster video drivers in real time.

invention or can be learned by practice of the present invention. It should be understood, however, that the detailed description of the invention and the specific examples presented, while indicating certain embodiments of the present invention, are provided for illustration purposes only because various changes and modifications within the spirit and scope of the invention will become apparent to those of skill in the art from the detailed description of the invention and claims that follow.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying figures, in which like reference numerals refer to identical or functionally-similar elements throughout the separate views and which are incorporated in and form part of the specification, further illustrate the present invention and, together with the detailed description of the invention, serve to explain the principles of the present invention.

Fig. 1 illustrates in hierarchical form the software running under the invention on a General Purpose Processor (GPP; the workstation, personal computer, or embedded system microprocessor) in combination with a reconfigurable image processing module (IPM);

Fig. 2 further illustrates in hierarchical form the software running on an IPM or equivalent hardware;

Fig. 3 illustrates an implementation of a user interface (in this case, VAPS) to the video library of the invention;

Fig. 4 illustrates the data and control flow from the display task through
2 to the video driver outputs when code is employed to drive one or more displays
of one or more display types;

4 Figs. 5-7 are block diagrams of data and control flow through the low
level Application Programmer's Interface (API) graphic drivers to the displays in
6 different display and display type configurations;

Fig. 8 is a block illustration providing an overview of an implementation of
8 the video library of the invention and its relationships to the video hardware and
other software;

10 Fig. 9 is a block diagram demonstrating device driver switching in the
invention; and

12 Fig. 10 is a flow diagram for decision making concerning device driver
switching.

14

DETAILED DESCRIPTION OF THE INVENTION

16

The present invention provides the ability to, on a single workstation,
18 personal computer, or embedded system, and using a single interface card if
desired, drive multiple displays of different types and to dynamically switch
20 between them in real time. A commercial standard graphics library (such as
OpenGL) is employed together with dynamically switchable driver sets allowing
22 support of multiple displays of different types. The invention also provides the
ability to use raster-based display formats (such as VAPS) with stroke or hybrid
24 raster/stroke displays.

2 The present invention enhances reusability by enabling a single display
routine to drive a variety of output types without the necessity of creating
separate display routines for each output type. By using a commercial standard
4 graphics library to create the display routine and tailoring the specific driver
functions to work with the graphics library, as well as requiring all graphic
6 interface to be through the graphics library, all hardware modes are isolated to
the device drivers. Device drivers can then be created and modified to match
8 the output without changing the display routine interface. The device driver set
necessary to drive the varying output type is associated with each graphic
10 context. When a graphic context is switched, the drivers are switched and a
different output can be displayed to. The drivers can be switched dynamically,
12 which makes multiple simultaneous outputs possible. This also allows for the
support of hybrid modes in which multiple drivers can operate for the same
14 output and drive raster and stroke on the same display if that display is capable.
The architecture conveniently supports multiple displays, various modes (e.g.,
16 stroke and raster), and future display types and hardware that may be
developed. A common software platform is thereby created that can be used
18 transparently for a wide range of hardware and software applications. As an
example, development of and modifications to graphics intensive operational
20 flight program software are greatly enhanced by the present invention.

The invention also enhances reusability by permitting the same VAPS
22 frame to be used to create display pages for both raster and stroke displays that
will look the same. Again, a commercial standard graphics library is employed

for linking the VAPS generated code to the display drivers. Accommodations
2 are made in the stroke drivers to ignore masking that is used by raster displays
and allow for the same effect by using occlusion memory for the stroke display.
4 A new graphics context is used for each virtual CRT as well as treating each
virtual CRT as a root CRT to get proper scaling. Each graphic context is tied to
6 a specific output driver set, and hybrid mode can be used with VAPS by
switching output drivers within a graphics context. Multiple outputs are also
8 enabled in this manner by creating additional virtual CRTs using different device
drivers.

10 The software preferably employed in the embodiment of the invention
employing an image processing module manufactured by Honeywell (IPM; e.g.,
12 a single VME card having a plurality of mezzanines for connection to a plurality
of displays) includes a Real-Time Operating System (RTOS) such as VxWorks,
14 the Tornado development environment, the OpenGL graphics language, and
the Visual Applications Builder (VAPS) display format development tool. Fig. 1
16 illustrates in block form the software running both on a General Purpose
Processor (GPP; the workstation, personal computer, or embedded system
18 microprocessor) and on the IPM. Shaded areas indicate reusable software.
Fig. 2 provides additional detail. Figs. 5-7 are block diagrams of data and
20 control flow through the low level API graphic drivers to the displays in different
display and display type configurations. Low level API pointers to the display's
22 raster or stroke drivers are preferably initialized only once during power-on

initialization. Fig. 3 illustrates an implementation of a user interface (in this
2 case, VAPS) to the video library.

The present invention also permits the same VAPS frame to drive both
4 stroke and raster displays. A commercial standard graphics library (e.g.,
OpenGL) links VAPS generated code to the display drivers to do either raster or
6 stroke. The stroke display drivers are preferably modified to ignore raster
masking and to use occlusion memory instead. Fig. 4 illustrates the data and
8 control flow from the display task through to the video driver outputs.

Hybrid displays can be driven from VAPS generated code as well as
10 multiple displays. VAPS was designed to drive a single raster output display,
but the present invention permits it to go beyond that limitation. The VAPS
12 portkit is modified to create a new graphics context for each virtual CRT. Each
virtual CRT is treated as a root CRT in order to achieve proper scaling. A
14 commercial standard graphics library (e.g., OpenGL) links the VAPS generated
code to the display drivers and each graphic context is tied to a specific output
16 driver set. Hybrid mode is rendered possible by switching output drivers within
a graphics context. Multiple outputs are rendered possible by creating
18 additional virtual CRTs using different device drivers.

Preferred design descriptions for the software of the invention next
20 follow:

Referring to Fig. 8, the preferred Video Library is a software interface for
22 graphics hardware that allows programs that use it to produce high quality
graphic images. The library allows a standard commercial interface to be able

8 The video control module is a set of functions that are needed for the
image processing module that can not be accomplished using the Open GL
10 libraries or the GL utility tool kit. This supports functions that are common
among the drivers. Preferred data structures include: display, context, driver,
12 and hybrid mode control, and hardware specific interfaces.

A subset of the GLUT kit library is preferably implemented for the image processing module of the invention. This library contains the functions necessary to initialize the display and setup the windows to put graphics in. This library follows the functional description of the GLUT API. The preferred data structures employed include the following: contexts initialization, context switching (device drivers switched with context), swapping buffers, color palettes control, animation control, and window state retrieval.

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used. These calls are made by video control and graphics libraries and are not
2 called directly by the display program.

The Graphics Library is intended to provide the only interface to the low
4 level graphic drivers. The graphics library includes a subset of Open GL
functions, Open GL utility functions, and Open GL utility tool kit functions.

6 The detailed descriptions for the preferred API GL Utility Functions are
specified: inOpenGL Programming for the X Window System, Mark J. Kilgard,
8 Addison-Wesley, ISBN 0-201-48359-9.

The detailed descriptions for the preferred API OpenGL functions are
10 specified in: OpenGL Reference Manual, Second Edition, Addison-Wesley,
ISBN 0-201-46140-4.

12 In summary, the present invention provides the ability to, on a single
workstation, personal computer, or embedded system, and using a single
14 interface card if desired, drive multiple displays of different types and to
dynamically switch between them in real time. Raster-based display formats
16 (such as VAPS) can also be used with stroke or hybrid raster/stroke displays.
The invention thereby enhances reusability by enabling a single display routine
18 to drive a variety of output types without the necessity of creating separate
display routines for each output type. The architecture conveniently supports
20 multiple displays, various modes (e.g., stroke and raster), and future display
types and hardware that may be developed. A common software platform is
22 thereby created that can be used transparently for a wide range of hardware
and software applications.

2 The embodiments and examples set forth herein are presented to best
explain the present invention and its practical application and to thereby enable
those skilled in the art to make and utilize the invention. Those skilled in the art,
4 however, will recognize that the foregoing description and examples have been
presented for the purpose of illustration and example only. Other variations and
6 modifications of the present invention will be apparent to those of skill in the art,
and it is the intent of the appended claims that such variations and modifications
8 be covered. The description as set forth is not intended to be exhaustive or to
limit the scope of the invention. Many modifications and variations are possible
10 in light of the above teaching without departing from the spirit and scope of the
following claims. It is contemplated that the use of the present invention can
12 involve components having different characteristics. It is intended that the scope
of the present invention be defined by the claims appended hereto. The entire
14 disclosures of all references, applications, patents, and publications cited above
are hereby incorporated by reference.

CLAIMS

The embodiments of an invention in which an exclusive property or right is claimed are defined as follows:

- 2 1. A display interface device for an individual personal computer,
workstation, or embedded system, said device comprising:
 - 4 one or more display interface means connectable to a computer
bus of said individual personal computer, workstation, or embedded system;
 - 6 means for storing video library information; and
 - 8 a plurality of means for driving any one of a plurality of video
displays of a plurality of types connected to said one or more display interface
means from output of said video library.
2. The device of Claim 1, wherein said video library information is
OpenGL video library information.
3. The device of Claim 1, wherein said plurality of driving means
comprises means for driving both stroke and raster display types.
4. The device of Claim 1, wherein said plurality of driving means
comprises means for simultaneously driving stroke displays of different types.

11. The method of Claim 10, wherein the step of providing a video library comprises providing a video library comprising OpenGL video library information.

12. The method of Claim 10, wherein the driving step comprises driving both stroke and raster display types.

13. The method of Claim 10, wherein the driving step comprises simultaneously driving stroke displays of different types.

14. The method of Claim 10, wherein the driving step comprises simultaneously driving raster displays of different types.

15. The method of Claim 10, wherein the driving step comprises driving hybrid stroke/raster displays.

16. The method of Claim 10, wherein the step of providing one or more display interface means comprises providing a plurality of interface card mezzanines.

17. The method of Claim 10 further comprising the step of dynamically switching between displays.

18. The method of Claim 17, wherein the dynamic switching step operates in real time.

2 19. A device for driving stroke displays using formats designed for raster displays, said device comprising:

4 means for linking generated code from said formats to a standard graphics library; and

6 stroke video drivers that ignore raster masking.

20. The device of Claim 19, wherein said formats are VAPS formats.

21. The device of Claim 19, wherein said standard graphics library comprises an OpenGL library.

22. The device of Claim 19, wherein said stroke video drivers use occlusion memory.

23. The device of Claim 19 further comprising means for driving both stroke and raster displays.

24. The device of Claim 23 further comprising means for dynamically switching between stroke and raster displays.

25. The device of Claim 24, wherein said switching means operates in real time.

- 2 26. A method for driving stroke displays using formats designed for
raster displays, the method comprising the steps of:
- 4 linking generated code from the formats to a standard graphics
library; and
- 6 providing stroke video drivers that ignore raster masking.

27. The method of Claim 26, wherein the linking step comprises linking VAPS generated code.

28. The method of Claim 26, wherein the linking step comprises linking to an OpenGL library.

29. The method of Claim 26, wherein the providing step comprises providing stroke video drivers use occlusion memory rather than raster masking.

30. The method of Claim 26 further comprising the step of driving both stroke and raster displays.

31. The method of Claim 30 further comprising the step of dynamically switching between stroke and raster displays.

32. The method of Claim 31, wherein the switching step operates in real time.

2 33. A computer device for driving multiple displays of different types using formats designed for raster displays, said device comprising:

4 means for linking generated code from said formats to a standard graphics library;

6 means for driving a plurality of displays of different types from output of said graphics library; and

8 means for dynamically switching between said displays in real time.

34. The device of Claim 33, wherein said graphics library comprises an OpenGL graphics library.

35. The device of Claim 33, wherein said formats are VAPS formats.

36. The device of Claim 33, wherein said driving means comprise stroke video drivers using occlusion memory.

37. The device of Claim 33, wherein said driving means comprises means for driving hybrid stroke/raster displays.

2 38. A computer device for driving a hybrid stroke/raster display using formats designed for raster displays, said device comprising:

4 means for linking generated code from said formats to a standard graphics library; and

6 means for providing stroke and raster display inputs from output of said graphics library.

39. The device of Claim 38, wherein said graphics library comprises an OpenGL graphics library.

40. The device of Claim 38 further comprising stroke video drivers using occlusion memory.

41. The device of Claim 38 further comprising means for dynamically switching between stroke and raster video drivers in real time.

42. The device of Claim 38, wherein said formats are VAPS formats.

2 43. A method for driving multiple displays of different types using formats designed for raster displays, the method comprising the steps of:

linking generated code from the formats to a standard graphics
2 library;
driving a plurality of displays of different types from output of the
4 graphics library; and
dynamically switching between the displays in real time.

44. The method of Claim 43, wherein the linking step comprises
linking to an OpenGL graphics library.

45. The method of Claim 43, wherein the linking step comprises
linking VAPS generated code.

46. The method of Claim 43, wherein the driving step comprises
employing stroke video drivers using occlusion memory rather than raster
masking.

47. The method of Claim 43 wherein, the driving step comprises
driving hybrid stroke/raster displays.

2 48. A method for driving a hybrid stroke/raster display using formats
designed for raster displays, the method comprising the steps of:
4 linking generated code from the formats to a standard graphics
library; and

providing stroke and raster display inputs from output of the
2 graphics library.

49. The method of Claim 48, wherein the linking step comprises linking to an OpenGL graphics library.

50. The method of Claim 48 further comprising the step of providing stroke video drivers using occlusion memory.

51. The method of Claim 48 further comprising the step of dynamically switching between stroke and raster video drivers in real time.

52. The method of Claim 51, wherein the linking step comprises linking VAPS generated code.

ABSTRACT OF THE DISCLOSURE

2 A display interface device and method for an individual personal
computer, workstation, or embedded system comprising one or more display
4 interfaces; a video library; and driving any one of a plurality of video displays of
a plurality of types connected to the one or more display interfaces from output
6 of the video library. OpenGL is a preferred API. Driving of hybrid displays as
well as stroke displays using formats designed for raster displays (such as
8 VAPS) is also provided for. Real-time switching between displays is also
provided for.

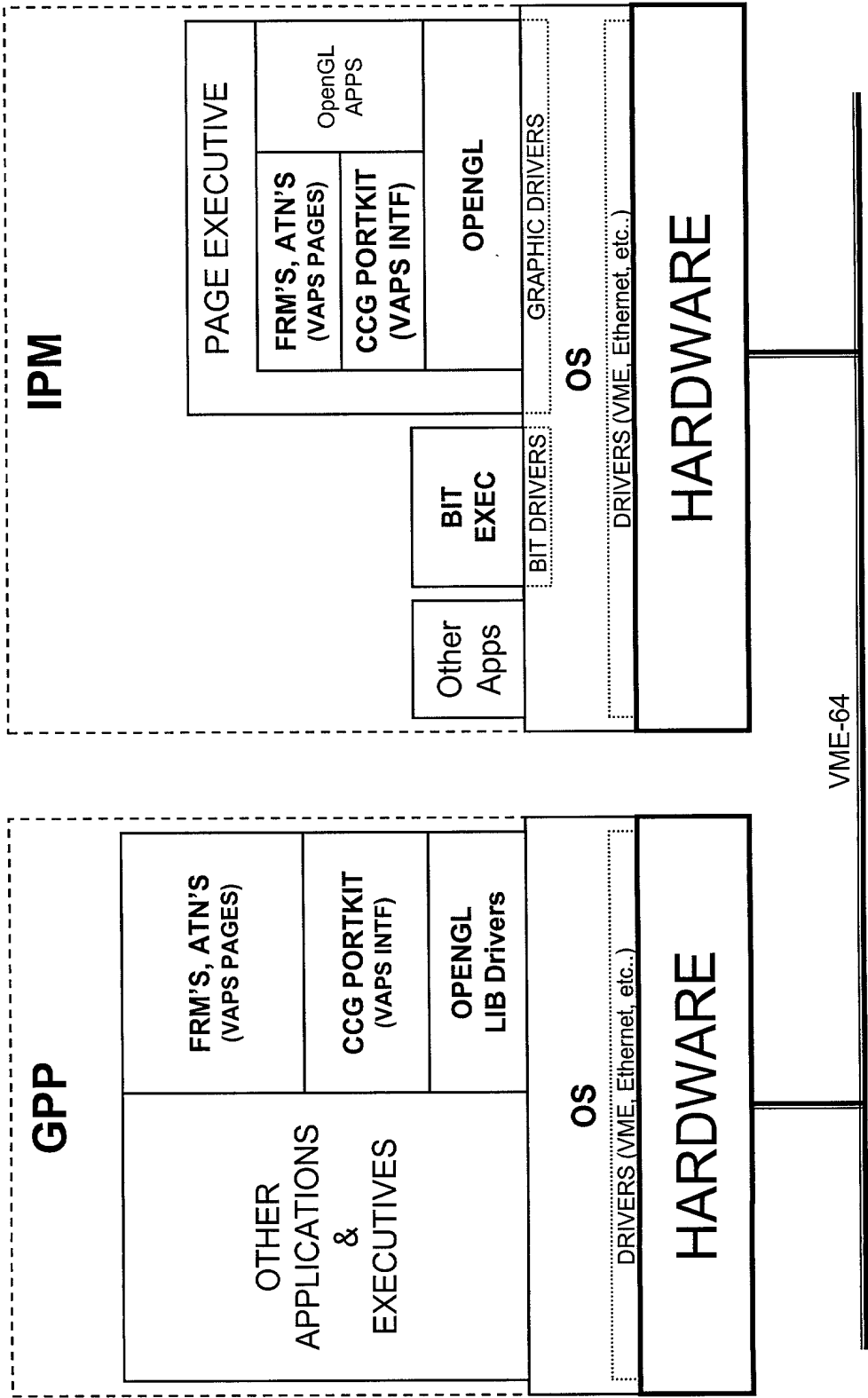


FIG. 1

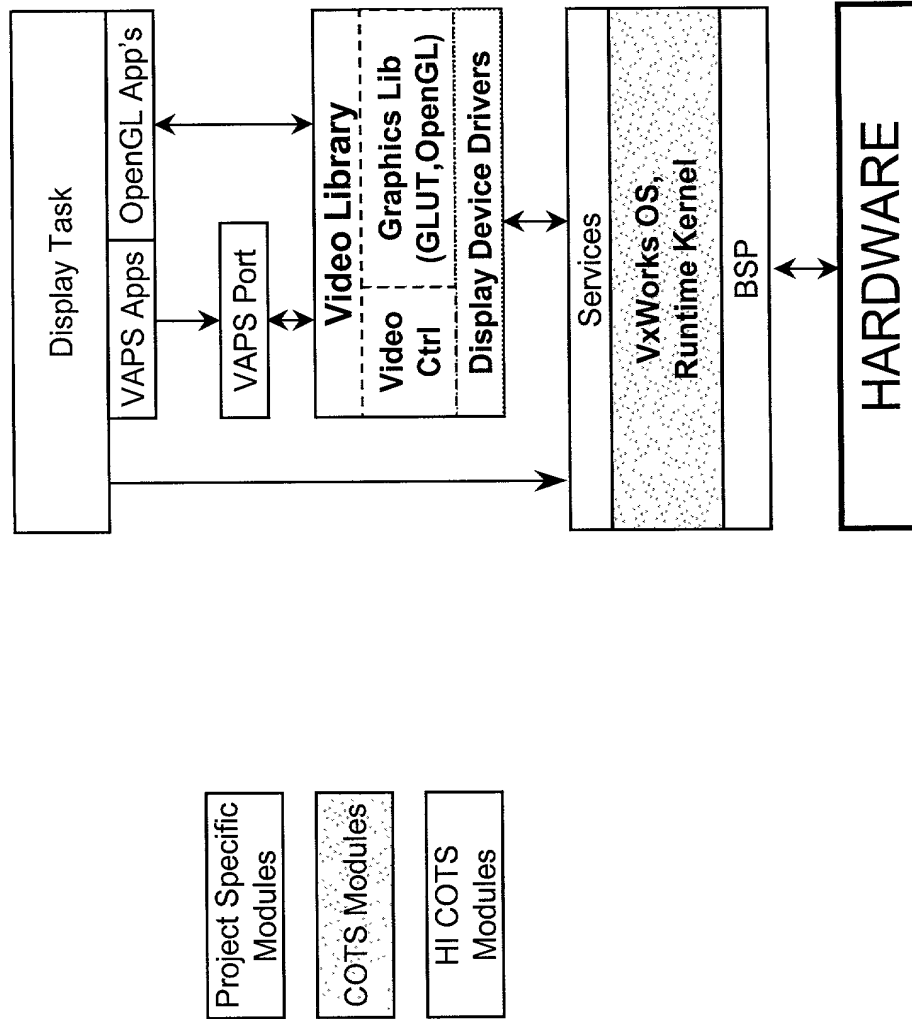


FIG. 2

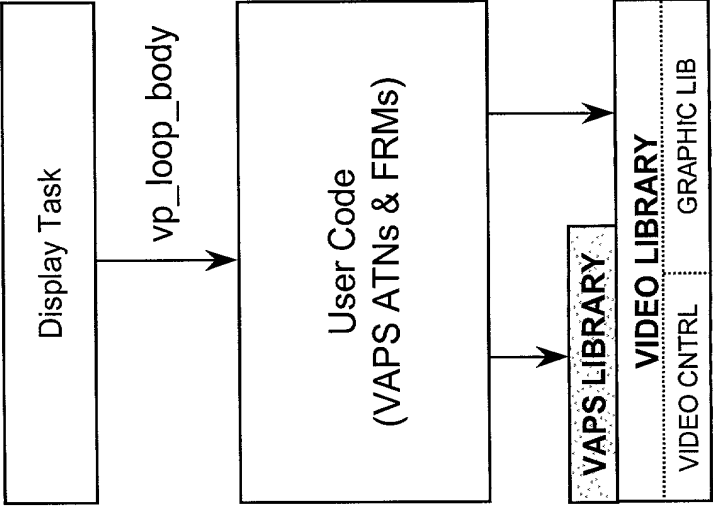


FIG. 3

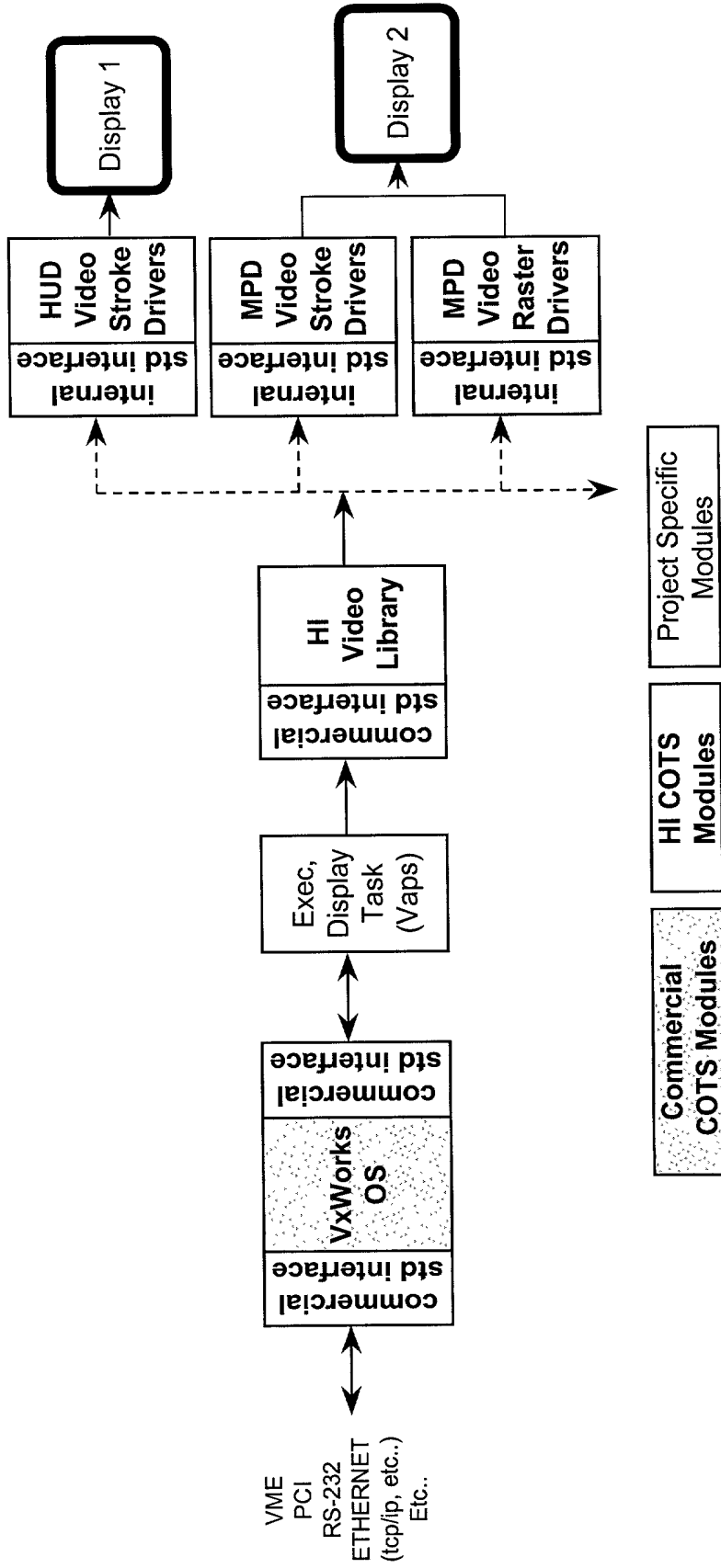


FIG. 4

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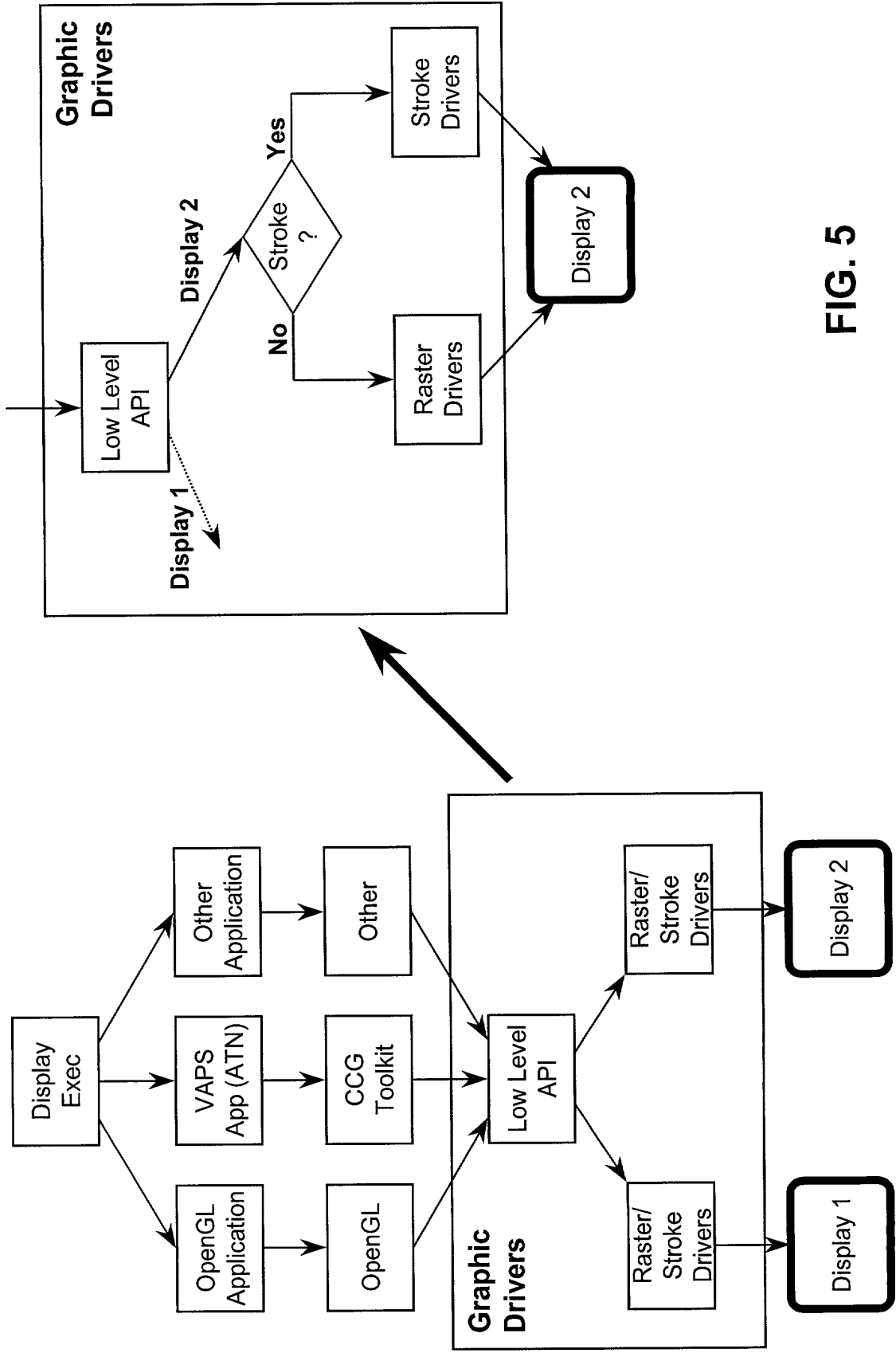


FIG. 5

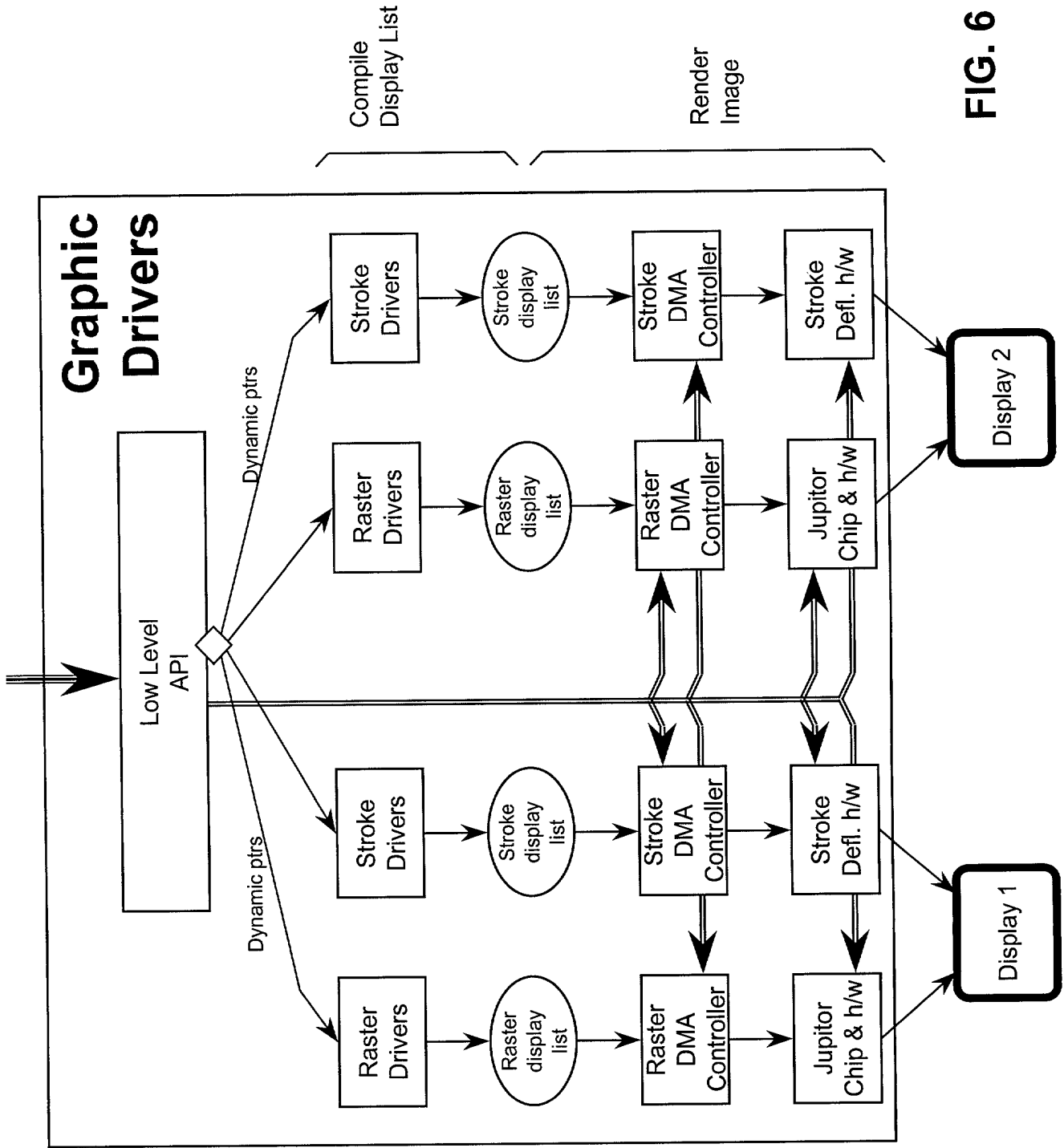


FIG. 6

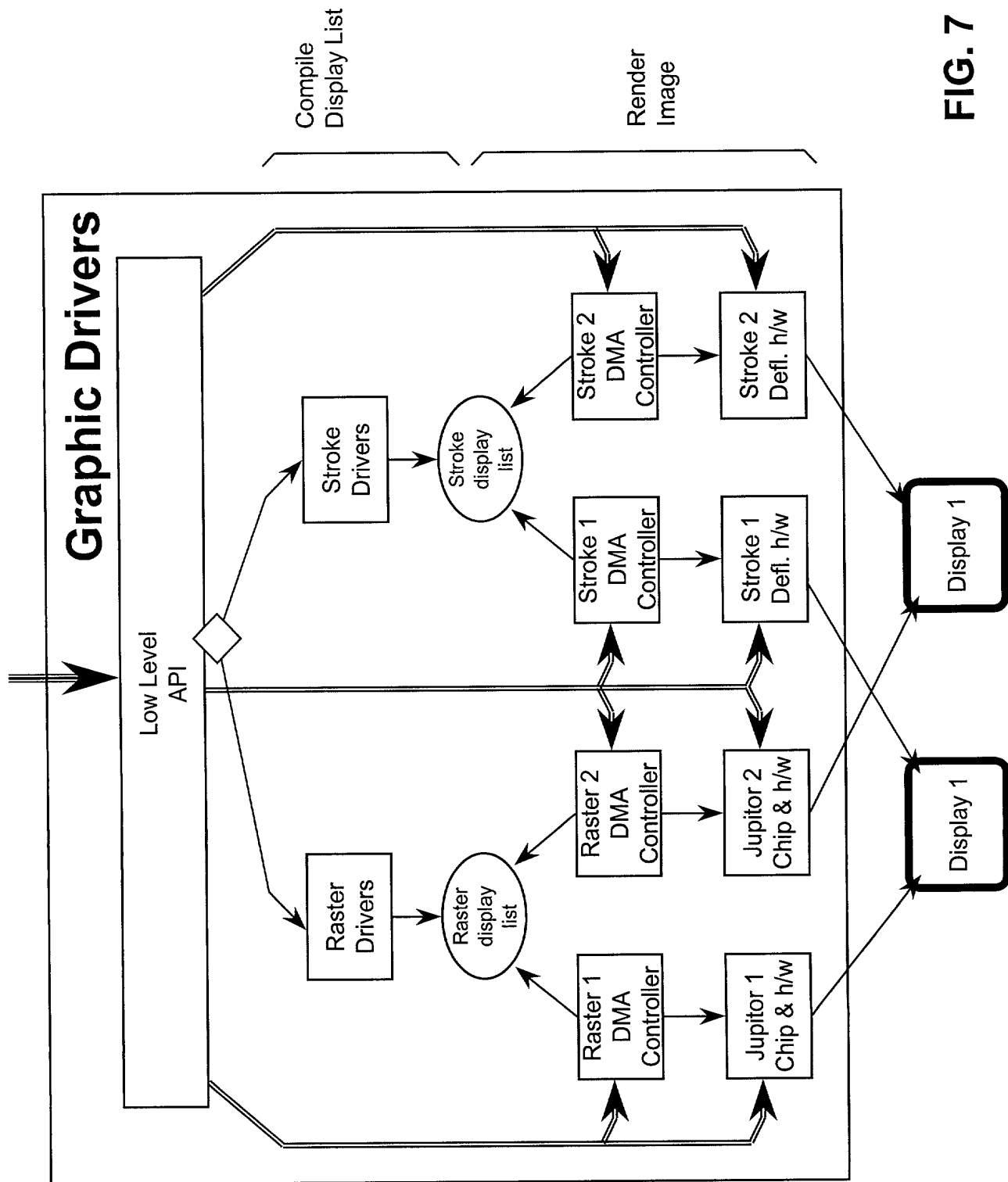


FIG. 7

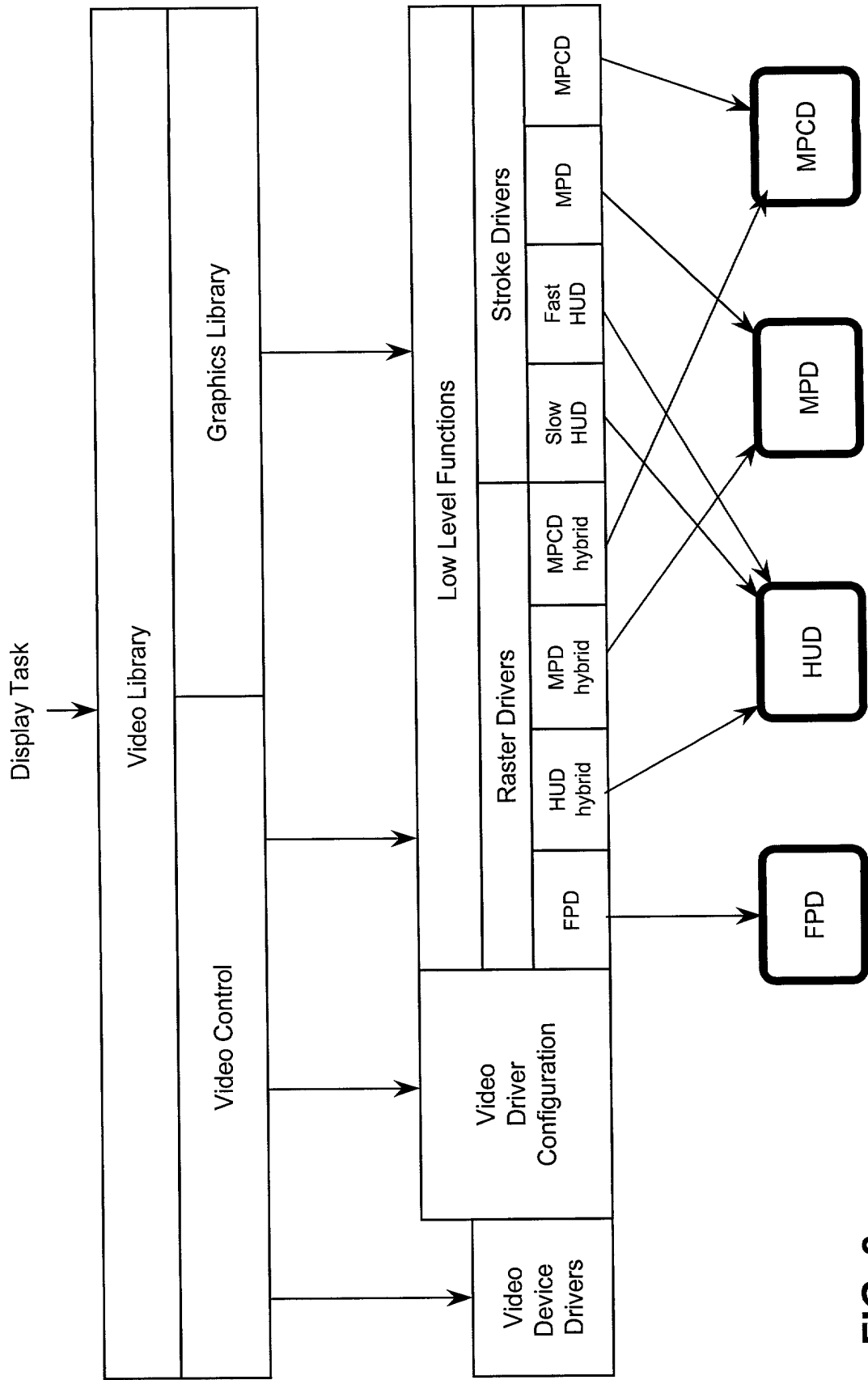


FIG. 8

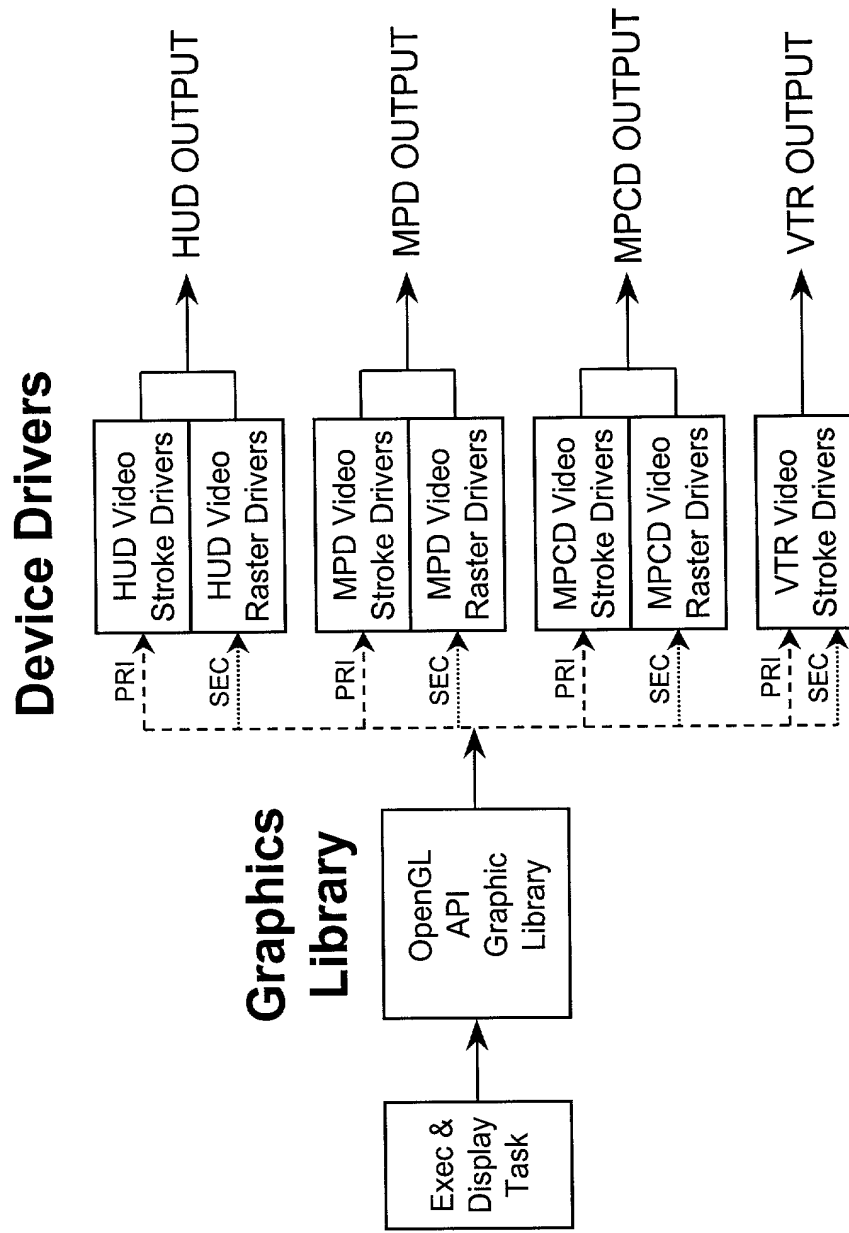


FIG. 9

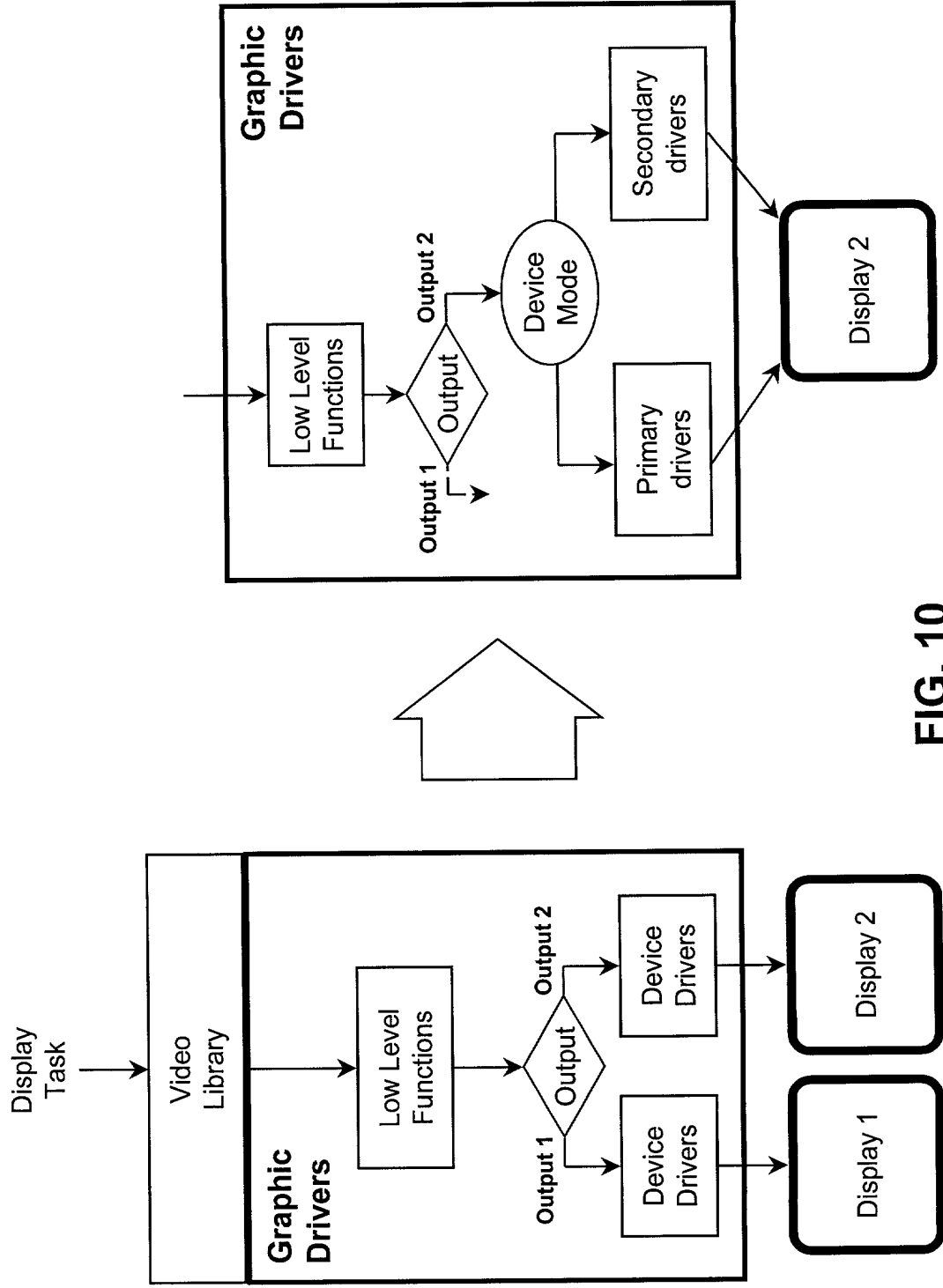


FIG. 10

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63) <input checked="" type="checkbox"/> Declaration Submitted with Initial Filing OR <input type="checkbox"/> Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)	Attorney Docket Number	A65-25311
	First Named Inventor	Cunningham et al.
	COMPLETE IF KNOWN	
	Application Number	/
	Filing Date	December 13, 1999
	Group Art Unit	New Application
	Examiner Name	New Application

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled.

MULTIPLE AND HYBRID GRAPHICS DISPLAYS

the specification of which (Title of the Invention)

☒ is attached hereto
 OR
☐ was filed on (MM/DD/YYYY) [] as United States Application Number or PCT International Application Number [] and was amended on (MM/DD/YYYY) [] (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)

☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

[Page 1 of 2]

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DECLARATION — Utility or Design Patent Application

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: ☒ Customer Number **000128** → Place Customer Number Bar Code Label here

☒ Registered practitioner(s) name/registration number listed below

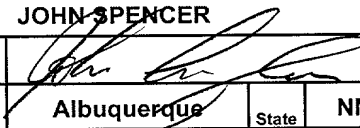
Name	Registration Number	Name	Registration Number
Andrew A. Abeyta	39,582		

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto.

Direct all correspondence to: ☐ Customer Number or Bar Code Label **000128** OR ☒ Correspondence address below

Name	Andrew A. Abeyta				
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Address	P. O. Box 524				
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Country	U.S.A.	Telephone	505/828-6534	Fax	505/828-6803

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor:		<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name (first and middle if any)			Family Name or Surname		
JOHN SPENCER			CUNNINGHAM		
Inventor's Signature				Date	12/13/97
Residence: City	Albuquerque	State	NM	Country	U.S.A.
Post Office Address	8012 BRIDGEWATER PLACE NW				
Post Office Address					
City	Albuquerque	State	NM	ZIP	87120
Country	U.S.A.				

☒ Additional inventors are being named on the 1 supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto

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DECLARATION
ADDITIONAL INVENTOR(S)
Supplemental Sheet
 Page 1 of 1

Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name (first and middle [if any])				Family Name or Surname			
SCOTT RICHARD				MAASS			
Inventor's Signature	<i>Scott Richard Maass</i>			Date	12-13-2000		
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Post Office Address	1617 STANFORD DRIVE SE						
Post Office Address							
City	Albuquerque	State	NM	ZIP	87106	Country	U.S.A.
Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name (first and middle [if any])				Family Name or Surname			
THOMAS A.				ODEGARD			
Inventor's Signature	<i>Thomas A. Odegard</i>			Date			
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Post Office Address	9504 NORTHRIDGE NE						
Post Office Address							
City	Albuquerque	State	NM	ZIP	87111	Country	U.S.A.
Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name (first and middle [if any])				Family Name or Surname			
Inventor's Signature				Date			
Residence: City		State		Country		Citizenship	
Post Office Address							
Post Office Address							
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